

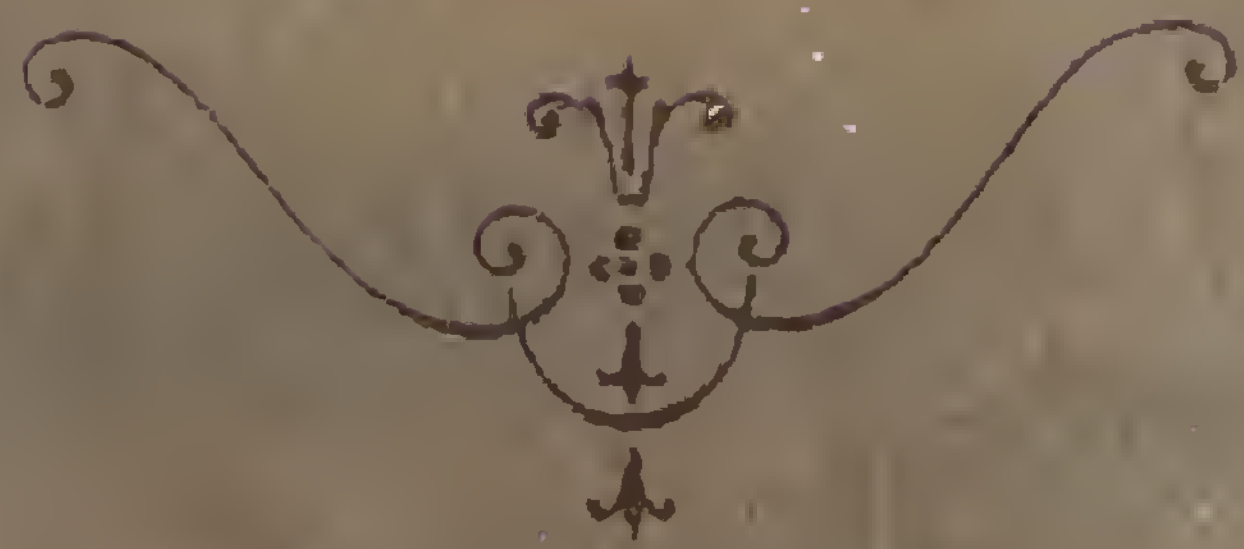
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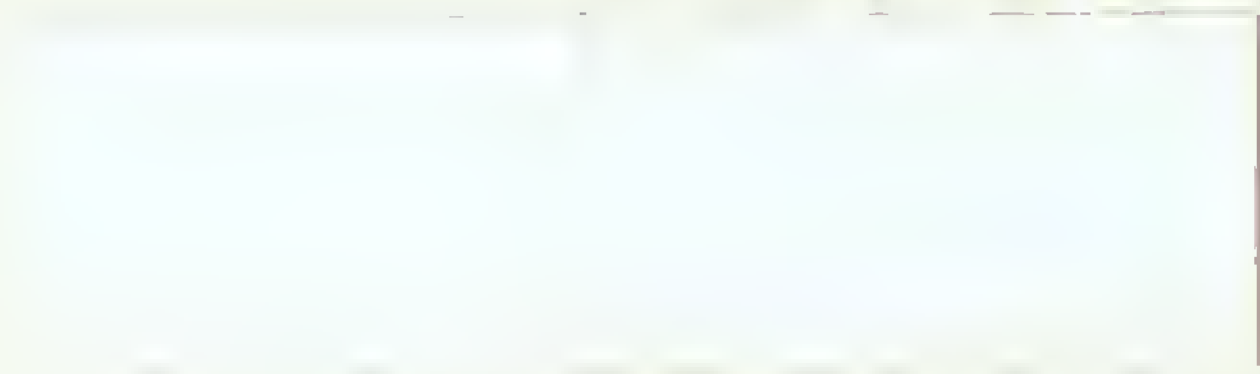




CLEAR & COLORED
FINISHES



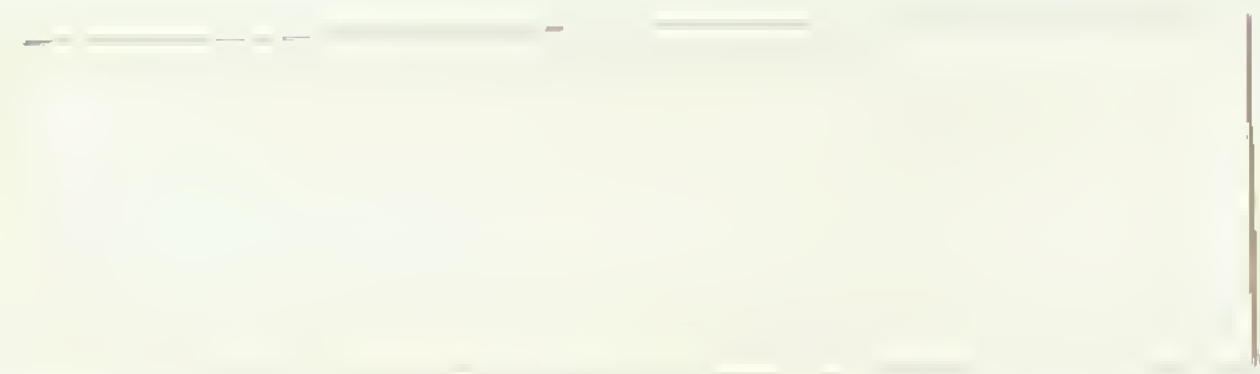
D U C O C O L O R S



2441 WHITE



2661 GLOSS WHITE



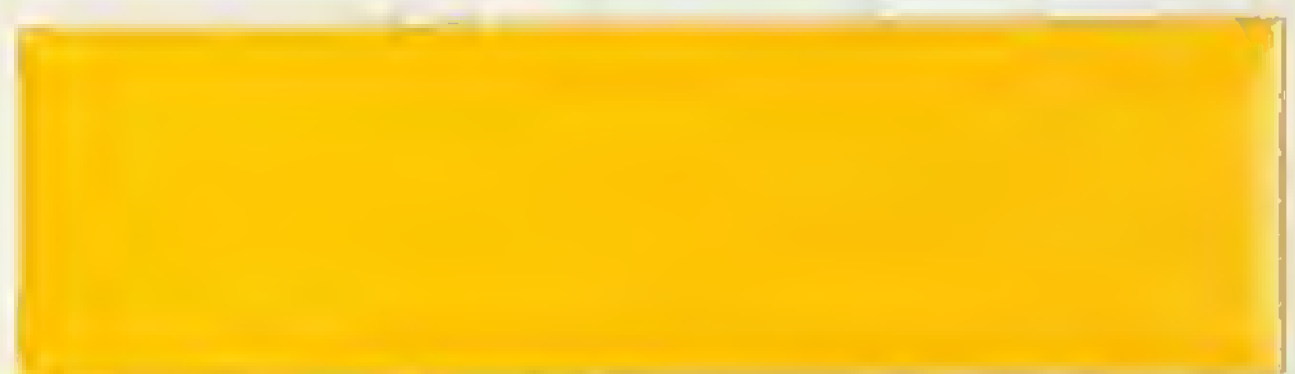
244114 IVORY



244281 IVORY



244877 ECRU



2447 YELLOW



24423 GRAY



244445 GRAY



2443 BLUE



244367 BLUE

See Back Fly Leaf for Other Colors



Clear & Colored Finishes

*General Information on
Their Many Uses, Application, Colors,
Color Mixing, Etc.*

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E. I. du Pont de Nemours & Company, Inc.

Sales Department, Chemical Products Division

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DU CO FINISHES

The Evolution of Finishes

THE earliest finish made by primitive man was probably a mixture of earth pigments with animal fat. Paintings of animals done with this grease-paint have been discovered in the caves of the Cro-Magnons in Southern France.

Long before the Christian Era, finishes much resembling modern varnish were in use in Egypt, China and Japan. Egyptian mummy-cases 2,500 years old have a finish which, though crudely applied with a spatula, is much like the ordinary clear finishes of today. The Greek painter Appeles used a mixture of resins and oils called "Berenice" for his work. The monks in the Middle Age compounded a similar mixture, and the same principle was employed by the artisans of the Dark Age in preparing finishes for the thrones and court furniture of their royal masters. During this latter period, however, more attention was paid to the carving of the pieces than to the finishing operation.

In Colonial times came the itinerant varnish peddler, with his mixing pots and kettles, his packages and cans of oils, gums, turpentine and solvents, traveling from factory to factory mixing his finishes in his customer's yard. He used materials similar to those still employed by many modern factories.

From the ancient Oriental, extracting his lacquer gums from trees, to the modern factory, methods of craftsmanship have undergone continuous change, but until the perfection of pyroxylin finishes the essential ingredients of finishes have remained basically similar.

Finishes and Automobiles When the first automobile bodies were made, habit was so strong in the builders that they manufactured an almost exact replica of the then popular buggy. In fact, "horseless carriages" was the popular name of the new vehicles for a long time.

Gradually body lines were changed to conform to the new propulsive power. The temperamental power plant was improved into

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an efficient, dependable engine. Comfort in riding qualities, even luxury in interiors, came naturally. Electrical ignition, self-starters and other features were added until the automobile had arrived as the most popular means of transportation.

But while these changes were being made, the finish on the automobile still harked back to the days of the buggy and the first "horseless carriages." The automobile finish was an antiquated relic by comparison with the other vast changes made in motor car construction.

While the automobile and finish manufacturers spent much time, money and effort to make improvement, the average finish still became dull, faded and lifeless in a year or less. No material had been found which could withstand continued exposure to sun and rain, hot days and cold, ice and engine heat, salt air and the abrasive action of mud and sand.

Late in 1923, the duPont Company announced the perfection of a new enamel—Duco. Made on an entirely new base and by new methods, the claims which could honestly be made for the new finish were so startling that the average manufacturer accepted them only with the proverbial grain of salt. But, in little less than a year Duco had so proved its qualities that it had been adopted by many leading automobile manufacturers, hundreds of shops were using it to refinish cars, hundreds of thousands of automobiles were on the road proving daily the unusual claims made for the new material.

Finishes and Furniture While the finish on furniture is not subjected to the outdoor exposure or hard usage which an automobile finish is expected to meet, nevertheless furniture finishes also lost their original beauty in too short a time. The bright, fresh, new appearance of furniture quickly disappeared to be replaced by a dead, lustreless, marred surface. The public was becoming more critical and needed only to be told about a more durable, more beautiful finish to cast its decision.

Duco Clear, announced to the furniture trade at approximately the same time Duco Colored made its debut in the auto show room, has achieved the same success as a more durable, more beautiful finish for indoor use.

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Finishes in General

What happened in the automobile and furniture fields is a fair index of what took place in other industries. Within a comparatively short time after its perfection, Duco had been adopted by several hundred manufacturers in thirty other industries manufacturing hundreds of articles.

Where Duco Is Being Used

As this booklet is being written, Duco is being used by twenty-five automobile manufacturers, some of them the largest in the country. Others will adopt this new type finish shortly. In addition, hundreds of refinishing plants in all parts of the country have standardized on Duco. This product is also being used on the following articles:

Automobile Accessories	Novelties	
Wood Furniture	Toys	
Metal Furniture	Electrical Parts	
Office Equipment	Piano Actions	
Pens, Pencils, Rulers, etc.	Umbrella and Cane Handles	
Washing Machines	Radio Boxes and Parts	
Lamps	Gasoline and Oil Pumps	
Handles for Tools, etc.	Bath Fixtures and Accessories	
Brooms, Brushes, Mops, etc.	Medicine Cabinets, etc.	
Typewriters	Locomotives	Toilet Seats
Railway Cars	Vacuum Cleaners	Truck Bodies

From this partial list of articles it can readily be seen that Duco can be used on a number of other objects of similar purpose, use or nature. Wherever a fast-drying, hard, tough, durable, waterproof, weatherproof finish would be an asset, Duco is the proper material to use.

Long Wearing

In addition to offsetting the disadvantages of former finishes Duco possesses many additional manufacturing and sales advantages. It was soon discovered that Duco was easy to apply and easy to sell to the public. Buyers readily appreciated the long-wearing, weather-and-time-resisting qualities of the new material. The result has been that, within a year and a half, Duco has become the most popular finish manufactured. This popularity is deserved. Duco has proved itself because of its ease of application, speed of drying, wearing qualities and attractive appearance.

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What Duco Is

The difference in qualities between the new finish and the old is explained by the difference in basic materials. Instead of the linseed oil and gums of ordinary finishes, Duco has as its basic materials cotton and acetate solvents.

Made from Cotton

In making Duco, selected cotton linters (short fibres of the cotton seed) are purified with steam, caustic soda and a forty-hour bath in hot and cold water. The cleansed cotton is then thoroughly dried, nitrated

and dissolved by the use of chemicals. A small percentage of gums is added for elasticity and gloss. In the colored formulas, pigments, carefully selected for color-fastness, durability and other qualities, are incorporated by a special process. The result is a solution which has the property of air-drying rapidly to a hard, tough, durable film.



In the Cotton Purification Building

Ordinary finishes dry by oxidization. Duco dries by evaporation. The first result of this difference is the fact that Duco is dry to the touch ten or fifteen minutes after application. Ordinary finishes do not dry naturally for hours. Again, oxidization is a slow, chemical change that renders the film of an ordinary finish

unstable. When oxidization is completed disintegration begins. But once a Duco film has dried by evaporation there is no chemical change—it is stable.

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Advantages of Duco The advantages of Duco are manifold and may be listed briefly as follows:

It is much harder and tougher than ordinary finishes.

It will not check, crack or craze.

It cannot become tacky or print.

It is not affected by heat or cold, hot dishes or icy glasses.

Boiling or ice water, even live steam, do not affect it.

The film is hard and difficult to scratch or mar.

It dries dust-free in fifteen minutes and hard enough for a second coat in a few hours.

Immediately after rubbing, buffing etc., the article may be shipped.

In addition, Duco Clear is more transparent than either shellac or varnish. Further, it will not scratch white.

A pleasing characteristic of Duco is its satin lustre. While the finish may be rubbed to a gloss, its users generally prefer the quiet, subdued, distinctiveness of its satiny sheen. However, for those who manufacture articles where a higher gloss might be preferable, we can tell them how this may be secured with Duco. On the other hand, when the clear finish is intentionally rubbed dull, it will hold its subdued tone.

This unusual finish is also flexible, expanding and contracting with the surface it covers. This flexibility prevents the film from checking, cracking or crazing with either age or climatic changes. Durability, combined with hardness and flexibility, assures the life of the finish for an indefinite period, resisting practically all deteriorating influences.

In comparison with baking japans, Duco is preferable. It does not require artificial heat for drying; it is available in colors other than black and possesses the qualities of hardness, weather-resistance and durability in an unusual degree.

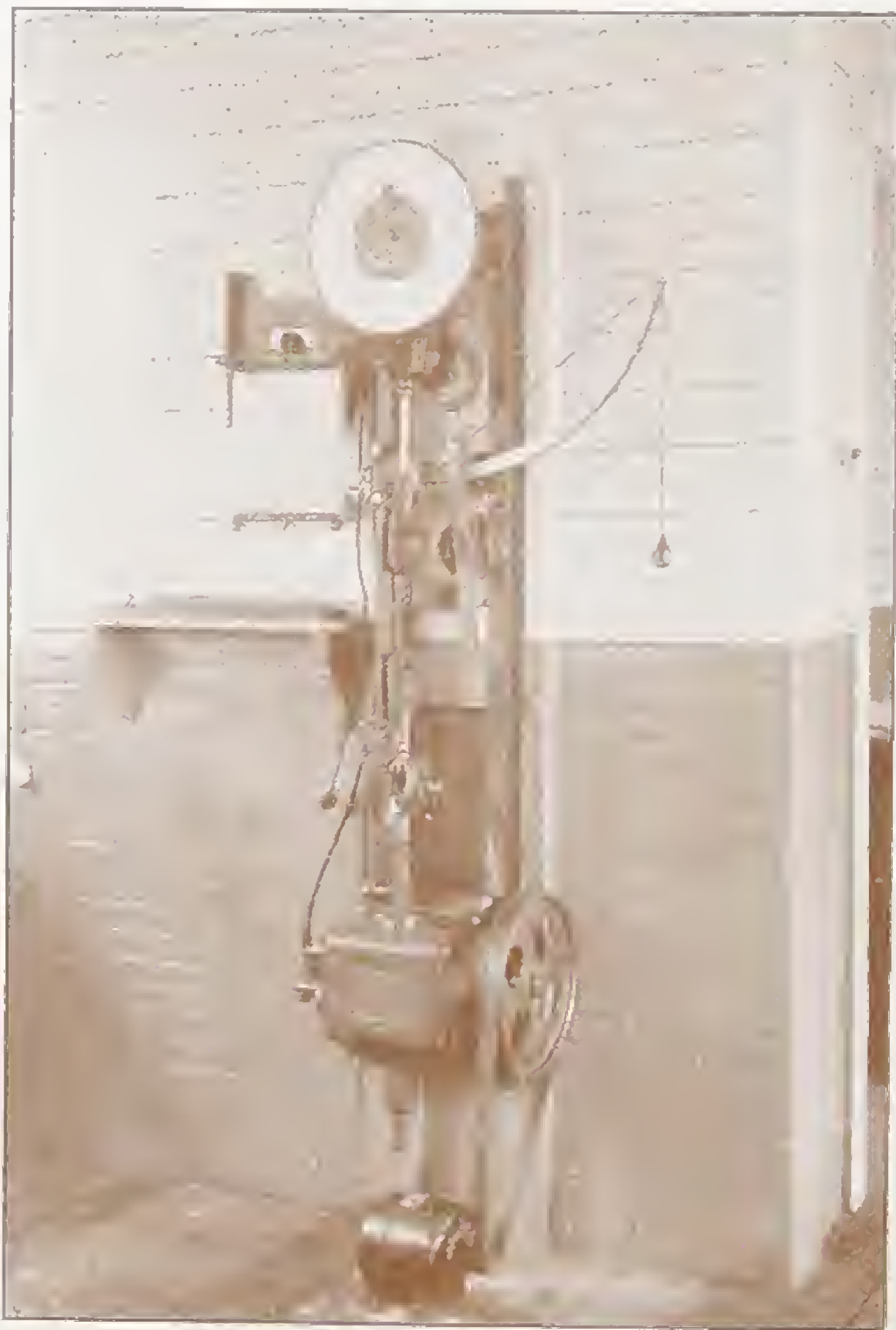
Some Unusual Tests The series of startling tests conducted by the Oakland Motor Car Company in 1924 are proof sufficient of the justness of our claims for the colored finish. Oakland dealers tested their Duco-finished cars with tar, battery acids, steam, ice, mud and even placed lighted matches on the finish. Some of these tests are much more drastic than we recommend but they were successful and fully demonstrated the wearing qualities of Duco.

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Articles finished with Duco have been subjected to extraordinarily hard wear for two years and at the end of that time are still as good looking as when they were first finished. Automobiles finished with Duco have been left outdoors day and night for twelve months subject to rain, ice, snow and hot sun. This is equivalent to at least several years normal usage. The finish still remains in excellent condition, giving evidence of continuing attractive for an indefinite period.

A customer subjected a Duco-finished piece of furniture to 950 pounds pressure per square foot. This pressure did not leave a print mark. At the same time a high-grade finish of the type formerly popular was ruined under 300-pounds pressure.

Another customer placed a Duco-finished case directly against an open, live steam jet. It remained there several minutes, was removed and immediately rubbed. The finish was not even softened by this drastic test.



Tensile Strength Testing Machine to Determine the Elasticity of Pyroxylin Finishes.

In another factory, immediately after rubbing, excelsior was placed on the finish and fourteen table tops put on the excelsior. This was left over night, but the next morning the finish showed not the least sign of printing.

In order to test the elasticity of Duco finishes, a panel finished in this material was immersed in a tank of boiling water, removed and immediately dipped in ice-cold water. The finish expanded and contracted with these sudden changes of temperature, not only without checking or cracking, but even without the least softening of the film.

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Duco Increases Production

Because of its quick-drying quality, Duco offers many manufacturing advantages. If the manufacturer desires to increase or speed up production, without additional space or labor, he can do so by saving hours of drying time. If stock held in drying rooms represents a non-interest bearing capital investment, Duco will reduce it to a minimum.

Under the old paint schedule it required 336 hours to paint one well known motor car body, while with Duco this time has been cut to 13½ hours. Labor time with conventional materials was 6.7 hours per body, which has been reduced to 5.7 hours with the Duco system. The cost of materials was \$2.33 per body, and it has been reduced to \$2.26 using Duco.

Cuts Drying Time In furniture factories, and kindred industries, the advantages of the new finish are even more significant. Ordinary finishes are notoriously slow drying. We will assume that in a finishing process three coats are applied. In the majority of such instances each coat will require from twelve to twenty-four hours to dry with usually a minimum of forty-eight hours total time for drying. In addition to this waste of time, a large drying space is required and in some cases artificial heat is necessary.

If the drying time can be reduced from 48 hours to ten or twelve, the plant's capacity can be increased, capital previously tied up is released, operating expenses are reduced and less floor space is required. Goods can be shipped to customers two or three days ahead of the usual schedule. Speedier delivery will furnish one sales advantage over competitors, while better appearing articles that stand rougher wear will be another.

A number of other sales advantages of tangible value result from the use of Duco. Your customers get a wearproof, waterproof, weatherproof, heatproof, beautiful finish. These qualities increase the value of your product—they will certainly help to get favorable attention.

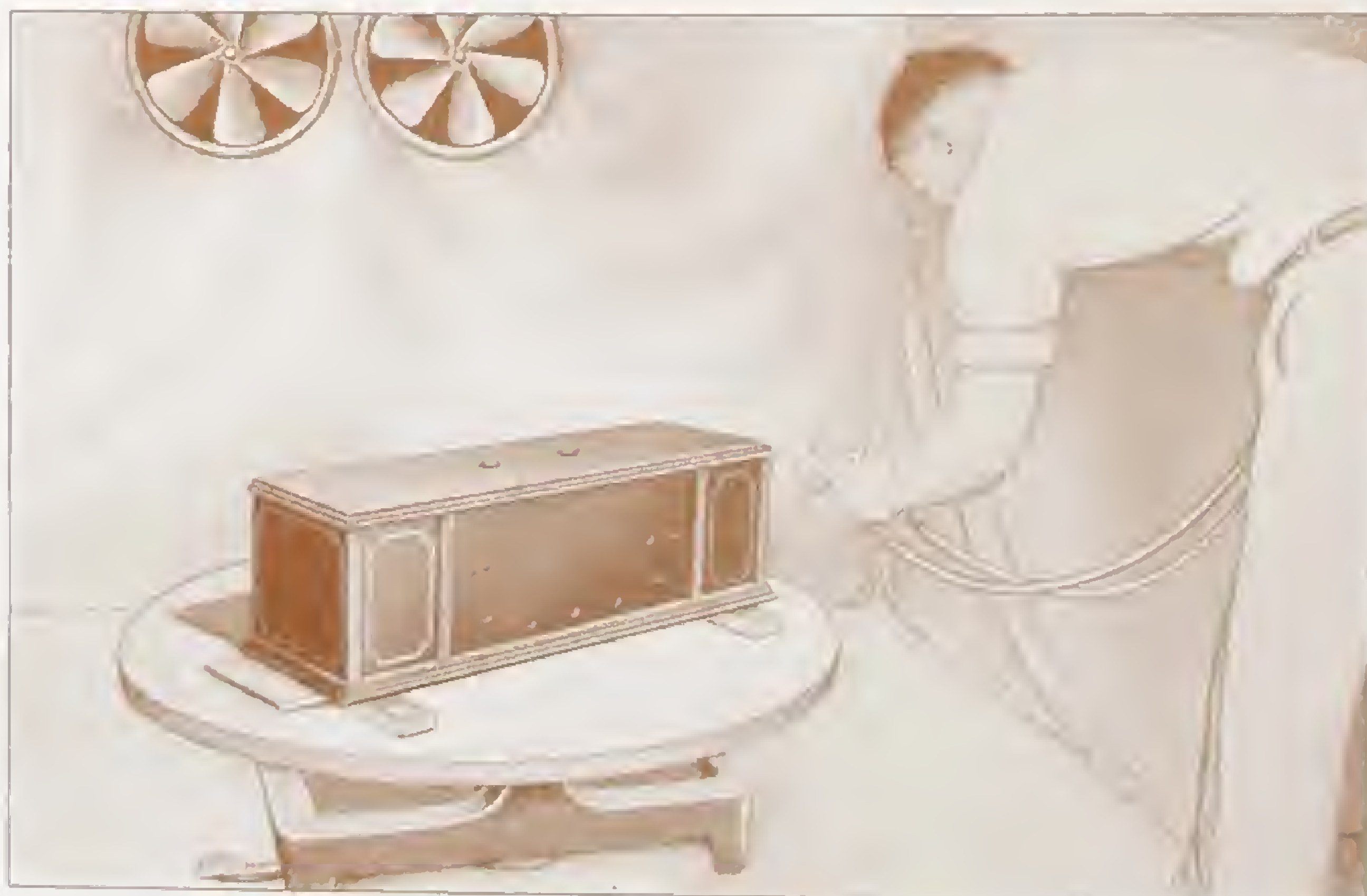
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How to Use Duco

This finish can be used on practically any wood, metal or composition article. However, there are special precautions to observe in the preparation of the article before the application of Duco. It is essential that the instructions given here be followed carefully if the best results are to be secured.

Types of Duco The type of Duco to be used by a manufacturer is determined not only by the specifications his finish must meet but also by the type of article and the facilities for application as well. He must be guided in his selection by whether he wishes colored finishes or clear, and whether they are to be applied by spray application or by dipping.

Colored Duco—for spray application—is the most popular of the Duco types. Offered in a wide variety of attractive colors, this type has gained unusual prominence as an automobile finish and is fast coming into popular use as a finish for wood furniture, metal furniture and office equipment, lighting fixtures, and scores of miscellaneous products.



Spraying Duco

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Clear Duco—for spray application—has been adopted in many leading furniture factories. This type is suitable for any wood finishing work, for interior use, its wearing qualities making an effective sales appeal.

For finishing by the dip method, Duco dip, both clear and colored, is meeting with approval. Because of the very rapid air-drying property of pyroxylin materials, only articles of regular contour—such as handles, pencils, rods, etc.—can be satisfactorily finished by the dip method. Where conditions are suitable, however, Duco dip is highly satisfactory.

Spray Application It is usually advisable when spraying Duco to use a larger gun and a larger nozzle than is ordinarily employed for spraying shellac or varnish. To the best of our knowledge any of the standard types of pneumatic spraying machines are satisfactory for use with Duco. The air for spraying should be clean and dry. Arrange the air intake so it will suck in only air which is free from moisture, dust and dirt. Use a filter attachment in front of the connection for the spraying hose. Be certain that your air line does not contain any water, oil or dirt.

If the pipe from the air tank to the spray booth has to run any distance, it should be arranged so it will run upward from the tank. The incline permits moisture to seep back into the air container. This should be equipped with a pet-cock at the bottom. The tank should be drained at least once a day.

It is generally advisable to use an overhead feed in applying Duco. The container should be raised as high above the spray booth as feasible in order to secure a better "fall," more pressure and greater covering power.

The air pressure will vary from thirty-five to fifty pounds, according to the type of work. A heavy mixture usually requires a heavier air pressure and vice versa. Care must be taken to have the Duco mixture of the proper viscosity or thickness. If the mixture is too thin it will cause runs and will not cover properly. If too thick it will spray unevenly, covering in ridges, developing sags and producing "spray dust" on the work.

In spraying Duco, even more than in spraying other finishes, care should be taken to apply an even coat. Duco will not flow like

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varnish; to get a smooth finish it must be applied smoothly. It is best to spray across a piece of work rather than up and down. If the sprayer is going over a small piece twice in the same operation it is usually best to start at the top, spray to the bottom and then back to the top again. For a larger piece spray crosswise from the bottom to the top. Lap each stroke slightly over the preceding one.

In handling the gun it has been found better not to use a wrist motion but, keeping the wrist stiff, to spray "from the shoulder" so that the gun always points directly at the piece and never at an angle. The gun is usually held about eight inches from the piece being sprayed, although this distance will vary from six to twelve inches, according to the thickness of the mixture being applied.

Ventilation For spray finishing it is necessary to prepare a booth in which the work can be carried on. This booth should be covered and should have an exhaust fan located directly behind the turntable or stand on which the articles being sprayed are placed. The fan will draw away solvent vapors and spray particles. For conveying these vapors or dust particles out of the building a tube can be constructed, leading from the fan to a window or special exit.

It is important enough to bear repetition that *Duco must be put on smoothly to get a smooth, even job.* *Duco does not "flow out."*

Surface Preparation of Metal

If it were possible to single out one characteristic required above all others in any finish, it would be adhesion. The manufacturer will later question the qualities of correct shade, attractiveness, durability and other finer points, but first and of prime importance he will ask—"Will it stick? Can I depend on adhesion?"

Duco possesses excellent adhesion. To obtain maximum results, however, the native ability of the finish to adhere tightly *must be assisted by a thorough preparatory cleansing of the surface.* All oil, grease and dirt must be removed.

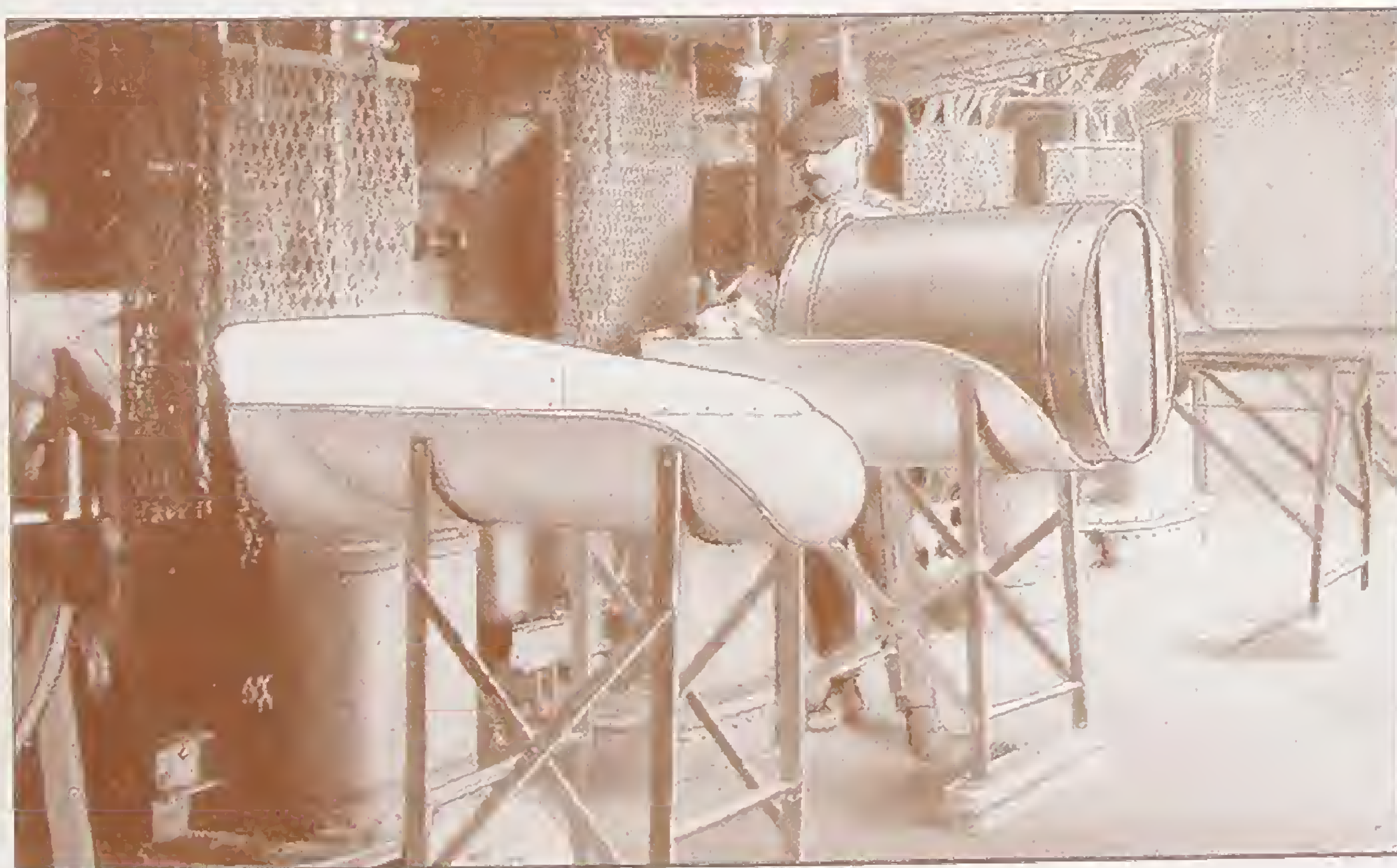
There are many methods of cleaning metal. Of these we specifically recommend two, either of which can be employed. These methods are sandblasting or acid pickling.

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Sandblast Where the manufacturer is equipped with sandblast apparatus we very strongly recommend this procedure, which consists, in the main, of spraying, under high pressure, fine grains of sand against the surface of the article, thereby cleansing and slightly roughening the surface by abrasion. Any particles of sand that may adhere to the surface can be blown off with compressed air.

Acid Pickling For the manufacturer not equipped in this manner, acid pickling is another method of cleaning metal for Duco. This process consists in formulating a weak acid solution which will dissolve oils, grease, or other foreign matter. A mixture of approximately ten or twelve parts water to one part sulphuric or muriatic acid answers very well for this purpose. The article being cleaned is given a bath in this solution. Upon removal from the bath it should be washed with warm water to remove all trace of the chemical and then thoroughly dried before proceeding with the finishing work.

If a manufacturer insists on finishing metal with Duco without sandblasting or pickling, it is essential that some process be used to secure an absolutely clean surface. Some manufacturers do this by using a cloth moistened with duPont thinner to wipe off the surface.



Charging Cotton Linters Into the Mechanical Dippers for Nitration

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Undercoats on Metal

Following the preparation of the surface as covered in the foregoing paragraphs, in many instances Duco can be applied directly to the metal. The determining factor here is the degree of smoothness of the surface. If the latter is extremely smooth, and has not been sandblasted, it is always most advisable to apply a prime coat.

On the other hand, where a rough surface is being finished, it is usually necessary to fill and surface with heavy bodied primers called fillers or "rough stuffs."

Passing over the average smooth metal surface, we may follow the surface preparation of a piece of rough steel or cast iron, requiring filling prior to the application of Duco. The general practice is to apply a primer (which may or may not contain pigment or other inert matter) to get maximum adhesion. (The surface has first, of course, been cleaned by sandblasting, pickling, or a thinner wash.) Over this primer subsequent coats of "rough stuff" can be applied. The composition of rough stuff is similar to the primer plus a high content of filling material.

Another method is to omit the first coat of primer and use a filler which is a combination of primer and a rough stuff.

Most primers and rough stuffs contain linseed oil. Usually the percentage of oil is higher in a metal primer than in a rough stuff. The quantity and quality of this oil content determine the drying time of the solution. Some primers and rough stuffs must be baked while others will air dry. Usually Duco can be successfully applied over either air drying rough stuffs and fillers or baked materials. The main consideration is that the oil must have thoroughly oxidized before pyroxylin is applied. The higher the temperature the more rapidly oxidation of the film is completed. For this reason Duco is generally used most successfully over fillers which have been baked.

On a smooth surface no filler is needed. If Duco will not adhere satisfactorily to the raw metal, the surface must be sand-blasted or given a prime coat. For this latter purpose, an air drying or baked oil primer or an air drying pyroxylin lacquer can be used.

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Types of Metal These instructions cover the general field of metal surfacing. Specifically, we will mention some of the common types of metal, inasmuch as the kind of metal used largely determines the process to be followed.

Steel Duco can usually be applied direct to a clean steel surface, unless it is very rough. For rough steel surfaces, filler used alone, or a coat of metal primer followed by rough stuff, may be used. The number of coats applied depends on the roughness of the surface, considering, of course, the manufacturer's requirements in a finish. Sanding the coats will assist in giving a smooth surface.



Centrifugal Wringer in Which the Nitrated Cotton is Freed from Excess Acid

Cast Iron If the castings are rough, treat as recommended above. Otherwise one coat of metal primer should suffice. Although we know better results will be secured if a prime coat is applied, some manufacturers have secured

good adhesion by applying Duco directly to cast iron. If this practice is attempted, the first coat of Duco should be a very heavy one. By this we do not mean a solution of higher viscosity than usual, but a slow movement of the spray gun, permitting the building up of a heavy Duco deposit.

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Brass and Copper On these metals Duco can be applied directly. It is quite essential, of course, that the surface be absolutely clean. If too smooth, the metal should be sandblasted or etched.

Tin, Aluminum and Zinc If possible, sandblast the surface. Otherwise it is necessary that it be acid dipped or boiled in a solution of caustic potash followed by a hot water wash. After this thorough cleaning, Duco can be applied directly to the metal. If the manufacturer is at present employing a priming solution he can also compare results in using the same material under Duco.

Colored Duco on Wood

Wooden articles—furniture, kitchen equipment, novelties, toys, and the like—are frequently finished in enamel. Duco has the advantage of air-drying rapidly to the hardness of a baked finish. Application of Duco on wood is comparatively easy. By this we do not mean that everyone will secure the best results offhand, but that excellent results can be secured with a minimum of expense and operations.

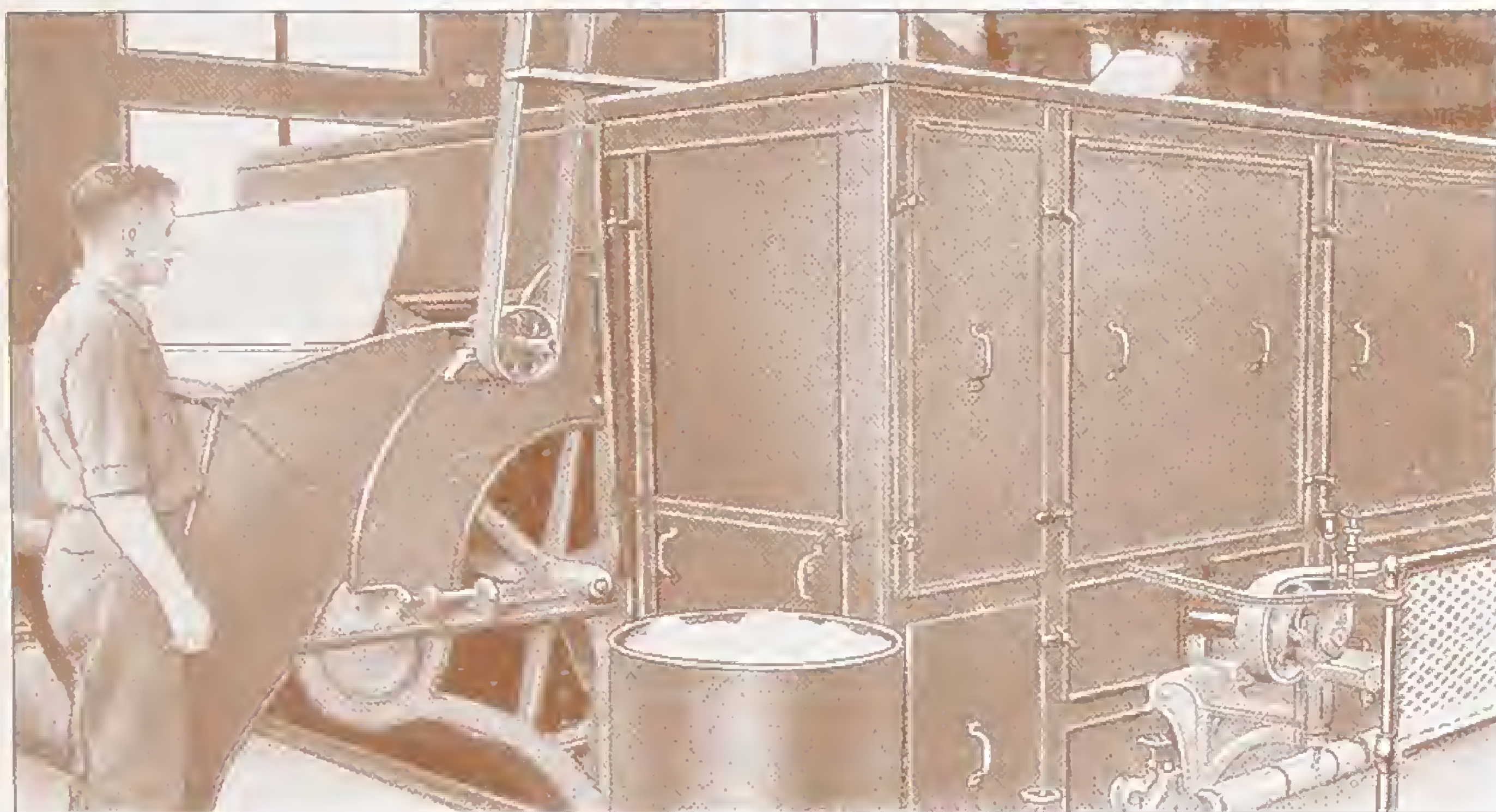
Open Grain Woods Woods of open grain—mahogany, oak, etc., require filling. For this purpose we recommend the use of standard wood fillers. Most of these are built on a linseed oil base. Over the filler when thoroughly oxidized, the successive coats of Duco are applied as previously described.

Close Grain Woods Close grain woods—maple, etc.,—do not, as a rule, require filling. The coats of Duco are applied directly to the stained wood surface.

Undercoats for Use on Wood Under Colored Duco

The du Pont Company has recently developed a surfacing material which, by reason of its superior filling property, gives very satisfactory results under colored Duco in wood finishing. This material is either sprayed or brushed on, allowed to dry over night, and is then thoroughly sanded. To those manufacturers who wish to

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Continuous Conveyor Type Drier for Drying the Purified Cotton

avail themselves of this new product, especially developed for this purpose, we suggest that they write us for further detailed information.

Colored Duco on Miscellaneous Surfaces

In this booklet we can do no more than indicate a few of the many uses of Duco. There are undoubtedly a great many industries, in which Duco could play an important part. Daily we are entering new fields. A few surfaces on which Duco is being successfully applied are mentioned:

Fibre Any fibre composition, like wood, is somewhat porous. To fill the pores, as a foundation for the Duco, du Pont Intermediate is applied. Several manufacturers have met with considerable success in finishing fibre materials with Duco.

Slate and Concrete While this field is comparatively new, good results have been secured in experimental laboratories in applying Duco on these surfaces both directly and over prime coats of Intermediate. If the former—a thoroughly clean surface is essential.

Asbestos Treat the same as fibre.

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Glass All glass surfaces must be sandblasted. Following this operation Duco can be applied directly to the surface obtaining excellent adhesion and producing a fine finish, characteristic of Duco in all its properties.

We invite correspondence regarding new or proposed uses. Technical laboratories are maintained for the solution of specific problems.

Duco Clear

Duco Clear, built on the same basic principle as the colored finish, does not contain pigment. It is a heavy-bodied, clear finish, adaptable to all types of wood finishing, as well as the finishing of kindred surfaces such as fibre. However, we recommend Duco Clear for articles of interior use only. Colored Duco is suitable for either interior or exterior use.

The superiority of Duco Clear as a wood finish is explained by Dr. A. P. Laurie, a Canadian authority, who claims that varnishes do not attain their maximum hardness until twelve months after they are applied. In the interim they are subjected to many trying conditions. Even after they have reached maximum hardness they are still chemically active. Duco, on the other hand, attains stability in a few hours.

Process of Wood Finishing

In finishing wood with Duco Clear there are several processes which may be followed for various types of finishes, as well as various qualities of the same type. As typical of the majority of furniture finishing rooms, we outline below a brief resumé of the method and materials used in obtaining a very good quality "built-up" finish.

- 1—Water stain—with any standard product of good quality.
- 2—Wash coat—a very thin coat of Duco Clear.
- 3—Sand.
- 4—Fill—using any good quality filler containing pigment colors only. As a reducer, use standard material—first ascertaining that no kerosene is in the solution. Benzine is suitable. The filler itself should be of hard-drying nature, containing no spirit or oil

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soluble colors. No oil should be added to the filler. Fill the pores flush with the wood and allow a drying time of at least forty-eight hours, with free access to fresh air. Be sure the filler is absolutely hard and dry all the way through before lacquer is applied.

- 5—First coat Duco Clear. Dry three hours.
- 6—Sand.
- 7—Second coat Duco Clear. Dry three hours.
- 8—Third coat of Duco Clear. Dry one to two days.
- 9—Rub.

This outline pertains to the finishing of open grained woods, such as mahogany, walnut and oak. In dealing with close grain woods, the wash coat and filling operations are not required.

The formula used and character of the finish desired determines thinning proportions. Specific information will be furnished on request.



A Battery of Mixers in the Enamel Plant

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Fibre

In turning to other surfaces on which Duco Clear may be applied, two features should be borne in mind. The first is that this material is unsuitable for metal finishing. This company manufactures special clear lacquers for metal finishing but Duco Clear is designed for use only on wood, fibre, and composition surfaces. In fibre finishing the character of the surface largely determines the formula to be used and also governs the finishing operation. Specific information will be furnished on request.

Dipping

The exceedingly rapid air-drying property of Duco necessitates application by mechanical means. It cannot be hand-brushed because it dries too quickly to flow out evenly.

Certain articles, however, because of their regular contour, are well suited for finishing by the dip method. Illustrative of this type of article are pencils, penholders, canes, and broom handles. For this work Duco dip finishes have been evolved. They are basically similar to Duco for spray application, but, through the incorporation of special, slow-drying, pyroxylin solvents, have been made suitable in every way for dip work. Unannounced, they were offered to certain customers who had need for this type of material. In practically all instances favorable reports were received, acknowledging our success in the new field.

Because of the higher ratio of pyroxylin to pigments as compared with ordinary enamels, this Duco type finish gives an unusually hard and durable film. Adhesion is excellent, so good that the material may be satisfactorily applied to any wood or any metal (except aluminum) without the use of a prime coat.

Method of Application The surface must first be thoroughly cleaned. Following this operation, it is our suggestion that test work be carried on, using the Duco unthinned, maintaining a slow rate of withdrawal. Should objectionable drips or runs form, or if the rate of withdrawal is considered too slow for your requirements, thinner may be added. The addition of thinner permits an increase in withdrawal rate, but reduces the build or thickness of the film deposited. The faster the

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Battery of Miniature Mixing Machines Used
in Laboratory Tests

speed of withdrawal (without increase in amount of thinner), the heavier will be the finish. A rapid withdrawal speed, however, increases the liability of runs or drips forming. With some articles it is possible to remove this drip at the end by means of a brush.

We strongly recommend some form of mechanical dipping machine with a withdrawal speed control. This should be flexible to allow easy adjustment to different speeds.

If it is found necessary to add thinner, this should be done so that the mixture can stand overnight. It is desirable that the dipping tank should have sides as high above the surface of the enamel as below in order that the accumulation of solvent vapor may assist in removing drips and bubbles; further, that an interval of approximately three hours should be allowed between successive coats.

Brushing

We do not recommend Duco for brush application. The solvents dry so rapidly that it is very difficult to secure a good finish, even by employing special thinners designed for the purpose.

General Information

Thinning Duco, although a liquid, is not ready to spray as packed, but must be reduced in viscosity before application. For this purpose we have specially prepared pyroxylin thinners, clear solutions built of pyroxylin solvents and diluents which function in a manner similar to turpentine used as a paint reducer. Nothing but du Pont thinner should be mixed with Duco.

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Duco is usually thinned approximately 35%. This means a solution consisting of about two parts Duco and one part thinner. Mix thoroughly with a paddle or similar device. If a mixed solution is allowed to stand overnight, or for any length of time during the day, it must be agitated once more just before operating the spray. If the solution is exposed to the atmosphere for any continuous period of time it may be necessary to add small additional quantities of thinner from time to time.

A different type of thinner is used with Duco Clear than is recommended for the colored finish.

Stirring Before removing Duco from the original container it should be thoroughly agitated. Shaking is not sufficient. A paddle should be used, of such length that the bottom of the can can easily be reached. Stirring vigorously will bring into suspension any pigment which may have settled.

Number of Coats

It is difficult to determine just what constitutes one coat in spray finishing.

This is entirely dependent on the operator. The slower the movement of the gun, the heavier will be the coat of material. The operator may retrace his course on the surface being finished without removing the gun and call the finish one coat. For all practical purposes, however, "one coat" means the thorough covering of the surface once by moving the gun slowly from one side to the other, with a slight overlapping.

When Duco is being applied directly to metal, many manufacturers find two coats sufficient. Frequently the first of these is



Boards on Which Duco Finishes Are Tested by Exposure to the Weather

D U C O F I N I S H E S

a heavy coat and is sanded when thoroughly dry. Of course, individual requirements will determine the exact number necessary.

In application over priming materials two coats will usually suffice. Automobile body finishers, requiring maximum results, occasionally apply as many as five, six or seven coats, thus building up an almost impenetrable film. For most finishing work, however, an adequate finish can be obtained with two or three coats.

Drying Time Between successive coats a drying time of approximately two hours should be allowed. This time depends to a great extent on the character of the surface. If a perfectly smooth, flat surface is being finished, the drying period between coats can be shortened considerably. On articles of irregular contour, or of very rough surface, it may be found necessary to exceed the two hour period. However, a coat of Duco will dry dust-free in ten to fifteen minutes and can be safely handled shortly afterwards. If an article is to be rubbed or buffed the last coat should be allowed to dry for a considerably longer period.



Close-Up of Panels in Outdoor Exposure Test

D U C O F I N I S H E S

Lustre-Gloss

Of recent years there has been a decided trend of public opinion away from the high lustre, piano gloss, finish. This movement is particularly noticeable today in a study of the furniture market, the automobile field, and fixture enameling. We no longer observe the finest furniture encased in a mirror-like finish; the public prefers a subdued, distinctive tone. The manufacturers of fine automobiles have found that the finish with the satiny sheen sells more cars than the high gloss of yesterday.

That Duco satisfies this growing demand is fully evidenced by the adoption of Duco Clear in the finishing rooms of some of the largest furniture manufacturers of the country, and the enthusiastic reception accorded the colored finish in the automotive industry. Duco gives a lustre known as "eggshell" gloss. The satin finish is obtained by hand-rubbing and polishing. Such polishing agents as rotten stone with boiled linseed oil are used for this purpose. For ordinary finishing work, however, this practice is not practical nor is it advised. If the manufacturer requires a lustrous finish, we can assist him through other methods. On articles subject to indoor exposure only, one general method is the incorporation of from 25% to 50% clear gloss lacquer in the Duco which is to be sprayed as a final coat. The lacquer will have practically no effect on the darker colors and will modify the lighter shades only slightly, but will heighten the gloss to a considerable extent. This mixture of Duco and lacquer must not be applied directly to the priming coats or to the surface of the article, however, as the lacquer weakens adhesion of the finish.

Where a very high lustre is necessary, and the added expense is justified, a Duco finished article can be given additional gloss by buffing with tripoli, rouge, or du Pont special rubbing compound. Hand rubbing will give the same results, in corresponding degree, but because of the characteristic hardness of the Duco film this is a rather tedious process.

Causes of Complaint

Blushing All pyroxylin solutions, being hygroscopic, are subject to this trouble. It is caused by the absorption of moisture from the atmosphere, occurring most frequently on humid

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days. It appears in the form of a light colored cast on the finish. This is actually cotton thrown out of solution. To overcome the difficulty it is necessary to retard the drying process. For this purpose a special concentrated thinner is prepared, which, when mixed in small quantity with the spray solution, will offset this precipitation. For the immediate remedy of blush on finished work, a stiff rub will often remove the trouble. If this is not sufficient a thin spray coat of duPont thinner may relieve the situation. For dip finished articles, a quick immersion in the regular thinner will generally overcome the difficulty.



Fastness of Color and Resistance to Ultra-Violet Rays are Measured in the Color Fadometer

Peeling In almost all cases peeling is caused either by using the wrong combination of solutions or by oil or grease on the surface being coated. All work must be entirely free from dirt or any oily substance in order to get satisfactory adhesion. Poor spraying also will often cause peeling. The work should look wet or glazed when the Duco goes on, so that it will flow out to a smooth finish. If it looks dry or pebbled it will not level properly. These little, rough particles are called "spray dust." Spray dust prevents proper adhesion and must be overcome by the addition of more thinner to the Duco, or by more careful spraying. Peeling is also sometimes caused by blushing.

Pin-Holes We know of five conditions which sometimes cause pin-holes in a Duco finish. Investigation should be made in order of their importance as follows:

D U C O F I N I S H E S

1—Oil or water in the compressed air line should be looked for. Make sure the air is clean and dry.

2—Find out the temperature at which the work is dried. For at least twenty minutes after spraying no heat should be used in excess of 90° F.

3—If the humidity is exceptionally high, drying in too cool a place should be avoided. Under such conditions drying should be done at or a little above room temperature.

4—A heavy coat of a mixture containing too much thinner will cause trouble. Try cutting down the percentage of thinner used.

5—If all of the above conditions are examined and found satisfactory the trouble must be caused by the nozzle of the spraying machine being too large for the air pressure used. Try increasing the air pressure or using a smaller nozzle.

Blisters Blisters are caused by the temperature of the solution or the drying room being higher than that of the article being sprayed. Any very small holes or pores in the surface of the article contain air which is of approximately the same temperature as the article. When the finish is applied and the article set aside for drying, an increased temperature will expand the air in such holes and raise bubbles or blisters on the surface.

To overcome such trouble have the Duco approximately the same temperature as the article being sprayed and do not use heat for drying until the finish has set.

Poor Covering Power In almost all cases of complaints about the poor covering power of colored Duco it will be found that some of the pigments have settled to the bottom of the container, which deprives the upper portion of its proper percentage of color. Shaking the container does not mix this up satisfactorily, so a broad stick or paddle should be used and the solution thoroughly stirred.

Sometimes such a complaint is made when it is not justified because the colored Duco is lighter in viscosity than usual. This gives many users the impression of deficient color ingredients, while actually the solution will cover the same amount of surface with the addition of less thinner. Viscosity does not vary in proportion to pigment content and should not be confused with covering power.

Effect of Heat on Pyroxylin Films

In what way are pyroxylin films affected by high temperatures? All statements made apply only to continuous temperatures under indoor conditions where the film is exposed to diffused sunlight instead of direct sunlight.

A pyroxylin film under ordinary room temperatures retains a slight amount of solvent, the presence of which is an essential contribution to the toughness of the film. If this residual solvent is driven off by elevated temperatures, the film becomes weak and brittle and shows a tendency to flake or chip off readily when struck a sharp blow. Both the degree of heat and length of exposure will determine the life of the film.

When the temperature gets as high as 212° F., a pyroxylin film not only continues to undergo the physical change represented by the loss of residual solvent, but it also undergoes a chemical change—a portion of the solids passes off in the form of gas, leaving behind a discolored residue. The chemical change is not very rapid at 212° F. but becomes more rapid as the temperature increases.



Typical of the New Type of Construction for Buildings at the Parlin Plant

D U C O F I N I S H E S

At 275° F. the chemical change is completely effected in a few minutes. The chemical change still further weakens the film and greatly reduces its toughness and adhesion.

For general requirements, the upper limit of temperature to which a pyroxylin film may be safely exposed is 150° F. At this temperature, the film will become brittle in a few days, but not enough to seriously affect the qualities of adhesion and strength. If the exposure continues the film will lose most of its life at the end of three to five months, and a sharp blow or abrasion will cause the film to chip and flake off easily. Of course, a lower temperature will be more favorable to the life of the film, and a film exposed to a temperature of 115° F. will probably retain its life long enough to make it practicable for most purposes. Nevertheless the film will in time become quite brittle.

Film exposed to a temperature between 150° F. and 212° F. will, depending on the particular temperature applying, deteriorate more rapidly than would be the case if the temperature did not exceed 150° F.

We do not consider it advisable to attempt to use pyroxylin films under conditions that will result in continuous exposure to temperatures of from 212° F. or higher in view of the physical and chemical changes that are bound to occur in the film. Of course where the exposure to high temperature is only occasional and not long maintained at any one time, temperatures well up to the upper limit of 275° F. may be tolerated.

One additional point to bear in mind is the fact that, particularly in the case of finishes of light colors, it is safe to keep within the limit of 150° F. to avoid the risk of discoloration.

Du Pont Service

Reasons for the superior quality of our products are basic:

1—All important raw materials used are manufactured at our plants, giving complete quality control over every ingredient.

For instance, the du Pont Company operates its own cotton purification unit. The result is a nitrated cotton—the basic material of all pyroxylin enamels and lacquers—of unequaled purity.

2—Every step in their manufacture, from raw cotton to the finished product, is checked against standards, insuring absolute uniformity.

D U C O F I N I S H E S



One of the New du Pont Laboratories

3—The finished product is carefully tested for viscosity, color and finish and must again check against standards before being packed for shipment.

4—A sample of every "mix" is kept on file, assuring the customer of exact duplication of his previous orders whenever desired.

Other du Pont Products

In addition to Duco, the Chemical Products Division of the du Pont Company also manufactures light-bodied lacquers and lacquer enamels, bronzing liquids, bronze powder, parlodion, collodion, belt cement, household cement, leather dopes, and commercial ether.

If you are interested in any of these products we will be glad to give you complete information on receipt of your inquiry.

E. I. DU PONT DE NEMOURS & CO., Inc.
Chemical Products Division
Parlin, New Jersey

D U C O C O L O R S



244402 RED



2445 RED



24498 ORANGE



24419 GREEN



244616 OLIVE GREEN



244557 OLIVE GREEN



24492 BLACK



26672 GLOSS BLACK



2446 BROWN

See Front Fly Leaf for Other Colors

